



Preproposal to The Sugar Bush Foundation

From: Dr. Greg Kremer, Associate Professor and Chair, Mechanical Engineering

The objective of this project is to research and create appropriate and adaptable technology in the form of a thresher/seed-cleaner/de-huller unit for small grains, beans, pseudo-cereals, and oilseed crops. The parameters of appropriate technology include, but are not limited to, simplistic design, adaptability, fuel efficiency, and scale-appropriateness for localized food production and procurement.

This objective is founded on the purpose of helping to solve the dual problem of loss of farmland and farmer employment and food insecurity in the Southeastern Ohio region, all underscored by rising and unpredictable fuel costs.

By providing appropriate scale, energy efficient technology for staple food production, we may help facilitate an emerging niche for regional farmers to put fallow land back into production. Furthermore, such infrastructure could support the use of fallow farmland that is owned by counties to grow high-calorie staple foods for growing populations of at-risk residents.

Moreover, involving Ohio University graduate students supports service learning and community outreach, consistent with the mission of Ohio University, the Russ College of Engineering and Technology, and the Department of Mechanical Engineering.

Rationale-Loss of farmland and food insecurity

Over the last 40 years, inexpensive petroleum fuel has posited the distant, large corporate farm at the core of our agricultural industry. Throughout rural Appalachian Ohio, the legacy of that industry includes food insecurity, fallow farmland, fewer farmers, and an epidemic of diabetes and obesity already on the rise among the poor and food-insecure.

Since 1982, Ohio farmland has decreased by 12.6 percent, putting the loss at well over 13 million acres.¹ In Appalachian Ohio specifically, 37.4 percent of local land is designated as ‘agriculture/open urban’ tracts, but agricultural business employs only 0.5 percent of the population. Usable farmland is sitting fallow, while the largest portions of the region’s staple crops are being imported from elsewhere. Appalachian Ohio fares the worst of all regions in the state when it comes to crop production, averaging a six percent row crop cover (by township) in the early 1990s. This gives rural Southeast Ohio the same row crop rate that larger, metropolitan areas of the state normally report.²

Appalachian Ohio residents bear a poverty rate of 13.6 percent (contrasted to greater Ohio’s 10.6 percent) and a steady unemployment rate of 7.1 percent.³ Directly linked with the region’s poverty is a lack of food security. Athens County households with children enrolled in the Head Start food program are rated as 49% “food insecure,” Overall, Athens County had approximately three times the level of food insecurity, and seven times the level of food insecurity with hunger, as the greater Ohio population.⁴

¹ <http://aede.osu.edu/Programs/exurbs/growthandchange/growth%20change%20section%20III.pdf>

² <http://www.odod.state.oh.us/appalachia.pdf>

³ <http://www.arc.gov/index.do?nodeId=56#Query1>

⁴ http://www.cdc.gov/PCD/issues/2006/jul/05_0127.htm

Yet food insecurity is not a condition that affects only the poor— every community depending on distant food sources is vulnerable. Given decreasing grain stores, flagging food banks, and wildly unpredictable food and fuel costs, underscoring the inefficient use of land in this insecure region, it is evident that a smarter regional food system is essential to the long-term well-being of residents and small farms of Appalachian Ohio.

Appalachian Ohio grows virtually no staple foods—grains, beans, pseudo-cereals, and oils—a bulk of the calories of a healthy diet. The Athens Farmers Market is considered one of the best in the nation for size, selection, and food stamp compatibility, but we see none of these foods at our vendors’ stands. Athens is home to several food outlets whose procurers are committed to locally produced food but lament the distinct lack of locally produced staple foods.

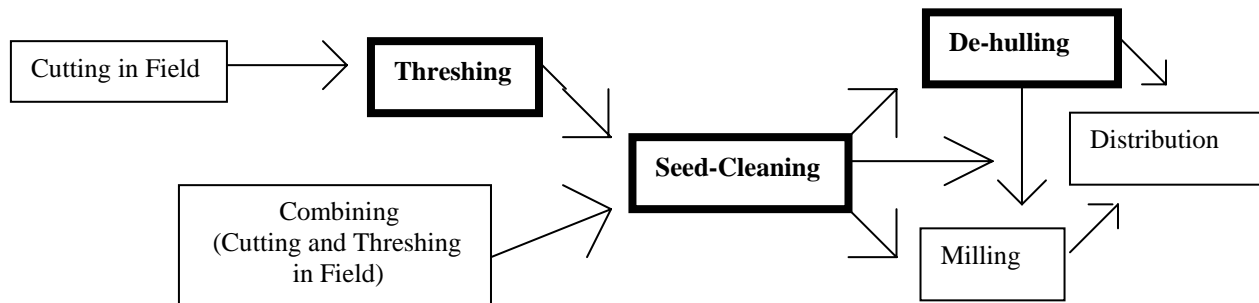
There are also countless examples of county-owned land that is very fertile and arable, but is sitting fallow, despite the food needs of so many residents.

The absence of these high-nutrition crops from the Appalachian Ohio landscape and the rise in fuel and food prices nationwide signal our region’s unstable food system, and the threat of food insecurity in our communities. They also represent an opportunity to increase regional farming, employment, and income and to ensure access to healthy local foods for all community residents.

Approach

While staple seed crops provide the bulk of nutrition and calories in healthy diets throughout the world, they require a relatively intensive post-harvest process to be made ready for preparation and consumption.

This process is illustrated in the chart below, with bolded boxes representing the portions of the chain that are to be addressed by this project:



Due to the relatively high purchase and fueling costs of combines, they are often not economically justifiable in the farming operations of Southeastern Ohio, which are characterized by small, irregular tracts of arable land. However, in small plots, where hand harvest is feasible, a stationary but portable threshing unit would well serve small-scale farmers who are focusing either on high-income specialty seed crops or on collaboration with other farmers to grow and process staple crops. A seed-cleaning unit would also be necessary for any seed-crop or seed-saving endeavor, and a de-huller is commonly required for processing small grains such as oats, barley, and spelt. Because these are all relatively simple to design and imperative to staple crop agriculture, they will be included in this appropriate technology investigation.

As evidence of feasibility, one example of a design for a small-scale thresher and cleaner, developed by Washington State University’s Vancouver Research and Extension Center, can be viewed at <http://sustainableseedsystems.wsu.edu/nicheMarket/smallScaleThreshing.html>.

This design is probably not directly applicable to our project, but it is a useful example of small-scale appropriate technology for agriculture.

In addition to investigating appropriate solutions to the challenges of small-scale staple food production, particularly in the processing phase, we will also determine an appropriate scale for product distribution area and number of processing units per area.

Stakeholders

We will be cooperating with a group of farmers who are working under a USDA Sustainable Agriculture Research and Education grant to investigate small-plot production of high-calorie staple food crops in the hilly terrain of Southeastern Ohio. This project is taking two logistical directions: One is to form a cooperative of staple food grower-processors to overcome the challenges of the regional terrain and economy. The other is to experiment with high-demand, specialty crops, such as amaranth and quinoa, which may make small-plot staple farming economically feasible.

A working network has already developed around this project among local non-profits, including ACENet, Rural Action, and Community Food Initiatives, and a larger network of local farmers and rural landowners has formed with interest in being involved in growing staple foods. Information from local farmers will guide the scope and particulars of this project, and working demonstrations of the outcome will be given on-site for interested farmers to be informed of the appropriate technology options.

This project will also be informed by the work of a collaboration of Athens County Commissioners, Athens County Job and Family Services, Community Action, and the Athens, Hocking, Perry Counties Regional Food Bank toward the objective of converting fallow County-owned land into high-calorie food production to supply social feeding programs serving local at-risk populations.

Principal Investigator

As a faculty member of the Mechanical Engineering Department at OU for over ten years, I have advised and supervised a large number of projects dealing with small-scale prototyping and appropriate technology. I have overseen an average of 50 students per year in our year-long Senior Capstone Design Project (more information on Sr. Design projects can be found at: <http://www.ent.ohiou.edu/~me470/>), served as the technical leader on an Engineers Without Borders Appropriate Technology project in Maase-Offinso Ghana, and supervised over 15 graduate student projects in areas ranging from biodiesel engine testing to the development of an appropriate technology human powered cargo vehicle to assist farmers in developing countries with a need to get products to market over rough terrain.

The Mechanical Engineering Department has access to facilities to do design and prototype activities appropriate for this scale of equipment. Capable graduate students in the department are highly interested in this kind of hands-on, immediately applicable work that can have a real impact on the community of which they are a part.

Incidentally, an appropriate technology design for staple food production would serve not only the population of Appalachian Ohio, but also much of Appalachia, as well as small communities worldwide, where technology, money, and large tracts of flat land are relatively scarce. This is growing increasingly important, as the means of shipping goods are becoming increasingly cost-prohibitive.